There is a traditional view that these animals were ponderous and sluggish. This view may apply in a measure to *Brontosaurus*. In the case of *Diplodocus* it is certainly unsupported by facts.

As compared with the Crocodilian or Cetacean type, the axial skeleton of *Diplodocus* is a marvel of construction. It is a mechanical triumph of great size, lightness and strength. Judging by the excessive rugosity of the vertebræ and limbs, the powerful interspinous ligaments attached to the pre- and post-spinal laminæ, the backwardly directed rugosities at the summits of the diapophysial laminæ in the dorsals, and of the postzygapophysial laminæ in the caudals, the animal was capable not only of powerful but of very rapid movements. In contrast with *Brontosaurus* it was essentially long and light-limbed and agile. Its tail was a means of defense upon land and a means of rapid escape by water from its numerous carnivorous foes. Its food probably consisted of some very large and nutritious species of water-plant. The anterior claws may have been used in uprooting such plants, while the delicate anterior teeth were employed for prehensile purposes only. The plants may have been drawn down the throat in large quantities without mastication, since there were no grinding teeth whatever. It is only by some such means as this that these enormous animals could have obtained sufficient food to support their great bulk.

Henry Fairfield Osborn.

THE NOMENCLATURE OF THE NEW YORK SERIES OF GEOLOGICAL FORMATIONS.

The prime outcome of the work of the four geologists, Mather, Emmons, Vanuxem, Hall, engaged upon the original survey of the State of New York, was the promulgation of a series of terms designating and classifying the rock formations. Many of the terms adopted in the final reports issued in 1842–1843 had been previously introduced in the annual reports of one and another of the geologists, but that finally announced was the mutual agreement of the four. Tradition and contemporary record have given us some evidence that differences of opinion as to the merits of various terms erected during the progress of the survey were not wholly reconciled by the final pronouncement which rejected a goodly number of provisional names. It was clearly the purpose of the geologists to institute and defend a classification of the older rocks, the stratigraphic units of which were to be of approximately equal value. In several instances subdivision of such units was recognized; thus Hall and Vanuxem especially added the term *group* to some units as indicative of a minor subdivision of the strata. Emmons avoided this term wholly and Mather seldom employed it.

The geologists also made use of a broader assemblage of the units into associations termed by some of them *groups*, by others *divisions*. These were four in number, namely, beginning at the bottom: Champlain, Ontario, Helderberg, Erie, and a fifth, Catskill, was employed by Mather. There was pretty uniform agreement in the use of these broader terms and such slight discrepancy as became apparent in their application was no more than an expression of imperfect knowledge and of personal equation. It was a genuine misfortune to the New York nomenclature that disturbed and drove out these terms which are supremely adapted to the unequaled paleozoic succession from which they emanated. In many respects they meet the actual conditions far more satisfactorily than the European terms which we are now carrying. They are entitled to respect for their venerableness and, where consistent with the present state of knowledge, to recognition for their merit.

It will be observed that the classification proposed by the four geologists was wholly

stratigraphic. It did not purpose to express the time units or groups thereof except so far as such a subdivision of the strata must of itself imply a corresponding division of time. Nor did the geologists contemplate any uniform grouping of their units in terms intermediate between their major and minor divisions.

It has, however, come to pass that such a grouping of the early New York units has found its way into quite general use. Such terms as Niagara group, Hamilton group, Chemung group, are current expressions in contemporaneous writings and they are not employed at all in the sense in which they were sometimes used by Vanuxem and Hall. This fact is well known and it is generally recognized by all students concerned with the stratigraphy of the early formations, that this condition has come about indirectly through the influence of the important summaries of American geology published by the late Professor J. D. Dana (Manual of Geology, four editions). In presenting the succession of paleozoic events these works have treated the subject as history must be treated, as a succession of time units. These units, which have been termed epochs, were grouped together into periods, and each period was given the name of the most conspicuous, widely distributed or otherwise best characterized of its epochs. Thus have arisen terms for secondary divisions in the paleozoic history of New York which duplicate names that must remain permanently in use for time units and their stratigraphic equivalents. The duplicating terms thus introduced into New York history are the following: Trenton, Niagara, Onondaga, Corniferous, Hamilton, Chemung. The distinguished author to whom reference has been made never employed these terms in any other than a chronologic sense; the present frequent application of them with a stratigraphic meaning of precisely the same scope as the time divisions, is a perfectly natural and legitimate outcome. This practice has, however, not only caused confusion from duplication within the boundaries of the State, but it has led to much embarrassment in the correlation of the stratigraphic succession of other states with that of New York. The point has doubtless been reached when these terms, representing though they do important divisions of time and sedimentation, must give way to others of equivalent value which shall obviate the duplication and confusion with which we are now embarrassed.

This paper, frankly stated, is a proposition to substitute for these terms in their stratigraphic application and hence necessarily in their chronologic equivalence, a series of designations derived from characteristic localities of the New York paleozoic, and thus to preserve, under the necessity of change, the eminent title of New York State to its full and ancient representation in the classification of the paleozoic deposits and time.

Incidentally it also takes cognizance of and suggests a suitable remedy for the present incongruity in the nomenclature of the stratigraphic units. As the propriety and necessity of local terms for the designation of such units is generally acknowledged, those formations which have hitherto borne names of other significance are now superseded by appropriate geographic names.

1. Champlainic. This most appropriate designation was introduced by the concurrence of the four geologists for the formations here assigned to it (exclusive of the Potsdam sandstone), and it has clear right of way over the later application of the name to the period of post-glacial alluvium. That the later term has become ingrained in literature renders it all the more conspicuous as an infraction of the law and of the rights of the men who first proposed it. In the face of Champlain, 1842, the term Ordovician has no standing.

2. Ontaric. Vanuxem placed the base of the Ontario division at the 'gray sandstone,' Hall and Emmons at the Medina, Mather at the Shawangunk

THE NEW YORK SERIES.

ERA OR SYSTEM.	PERIOD OR GROUP.	AGE OR STAGE.
Cambric or Taconic	Georgian	Georgia slates
	Acadian	
	Potsdamian	Potsdam sandstone and limestone
Champlainic (1) (Lower Silurian and Ordovician)	Canadian (3) (Paleochamplainic)	Beekmantown limestone (15) Chazy limestone
	Mohawkian (4) (Mesochamplainic)	Lowville limestone (16) Black river limestone Trenton limestone
	Cincinnatian (5) (Neochamplainic)	Utica shale Lorraine beds (17) Richmond beds (Ohio and Indiana)
Ontaric (2) or Siluric	Oswegan (6) (Paleontaric)	Oneida conglomerate Shawangunk grit Medina sandstone
	Niagaran (7) (Mesontaric)	Clinton beds Rochester shale Lockport limestone Guelph dolomite
	Cayugan (8) (Neontaric)	Salina beds Rondout waterlime (18) Manlius limestone (19)
Devonic	Mesodevonic Paleodevonic: Helderbergian (9)	Coeymans limestone (20) New Scotland beds (21) Becraft limestone (22) Kingston beds (23)
	Mesodevonic Paleodevonic: Oriskanian (10)	Oriskany beds
	Mesodevonic Paleodevonic: Ulsterian (11)	Esopus grit (24) Schoharie grit Onondaga limestone
	Mesodevonic Paleodevonic: Erian (12)	Marcellus shale Hamilton beds
	Neodevonic: Senecan (13)	Tully limestone Genesee shale Portage beds (Naples beds, Ithaca beds, Oneonta beds, local facies)
	Neodevonic: Chautauquan (14)	Chemung beds (Catskill sandstone, (25) local facies)

grit. Vanuxem and Hall terminated the division above with the Niagara, Emmons included the Salina and waterlime. Any rational grouping of these formations must recognize as its base the predominance of coarse sedimentation installing a new cycle. Growing evidence fully endorses Emmons' view as to the termination of the group and period with the clearing of the Salina sea.

3. Canadian. This term has the prestige of time and priority.

4. Mohawkian. Conrad and Vanuxem made use of the term 'Mohawk limestone' for certain of the calcareous layers beneath the Trenton, but they differed so widely in their application of the term that in the summation of their results, the geologists decided to abandon it. The name is here revived with a broader meaning. The valley and watersheds of the Mohawk river afford typical exposures of all members of the group.

5. Cincinnatian. The formations of the Neochamplainic are not as completely developed in the State of New York as in Ohio and Indiana. In the latter sections the Lorraine fauna is represented, but is followed above by the well-defined fauna of the Richmond beds. Probably in no other region is the succession of these faunas so complete as about Cincinnati, and this fact justifies the recognition of the term Cincinnatian, which already has historic value. For a full description of the series by Winchell and Ulrich, see Geol. and Nat. Hist. Surv. of Minn., vol. 3, pt. 2, pp. ci–cv., 1897.

6. Oswegan. This name is appropriate on account of the widespread occurrence of the Oneida and Medina formations in Oswego County, N. Y. Vanuxem employed the term 'Oswego sandstone' for the formation subsequently and by common consent called Medina sandstone. In reviving the name, though with a broader meaning than in its original use, it derives its title from its early date.

7. Niagaran. In the sense suggested by Professor Dana.

8. Cayugan (new). The divisions of this group are knit together by lithologic and faunal characters and are distinctly Ontaric. The outcrops are typically exposed about the north end of Cayuga Lake, N. Y.

9. Helderbergian. The present state of our knowledge does not permit the use of the term Helderberg in its original scope. The 'Helderberg division' was made to embrace formations now regarded as constituting the lower and part of the middle Devonic. We propose to restrict the term Helderbergian to the formations currently known as 'Lower Helderberg,' excluding the 'Tentaculite limestone.'

10. Oriskanian. The Oriskany formation varies considerably in the character of its sediment. Its calcareous facies is highly developed in eastern New York, while the more siliceous sediment excludes all others in the central part of the state. The fauna of the Oriskany from its lowest beds, as at Camden, Tennessee, to its highest beds, as in the Province of Ontario, shows progress in differentiation, but it is not yet practicable to subdivide the New York development of the fauna.

11. Ulsterian (new). From the outcrops of all the members in Ulster county, N. Y.

12. Erian. The 'Erie division' comprised the formations from the top of the Onondaga limestone to the top of the Chemung. We propose to save the term to the New York nomenclature by reviving it with a restricted meaning.

13. Senecan (new). In Seneca county and along the shores of Seneca lake are excellent exposures of these beds.

14. Chautauquan (new). From exposures in Chautauqua county, N. Y.

15. Beekmantown limestone (new). The Calciferous sandrock of Eaton and authors generally. This formation took its original name from sections in the Mohawk valley, where the rocks are without fossils. At Beekmantown, N. Y., the normal fauna is finely developed and the rock section essentially complete.

16. Lowville limestone (new); instead of Birdseye limestone of common use. Lowville is a town in Lewis county, N. Y., where these beds are well exposed.

17. Hudson river beds. It is becoming increasingly evident that the great mass of shale in the Mohawk and Hudson river valleys which was designated at an early date by this term is resolvable into horizons extending from the middle Trenton to and including the Lorraine beds. At present it seems unlikely that when this determination of horizons has been carried through the series any part will remain to which the original term can be applied by virtue of its distinctive fauna, though it may still serve to designate a facies of the formations mentioned.

18. Rondout waterlime (new). From the fine development of these beds in the extensive cement quarries at and near Rondout, N. Y.

19. Manlius limestone. Tentaculite limestone of Gebhard, Mather and later writers. The name here used was introduced by Vanuxem and is entitled to first consideration. Manlius is the place of typical exposure in Onondaga county, N. Y.

20. Coeymans limestone (new); and

21. New Scotland limestone (new). These terms designate respectively the Lower Pentamerus (Helderberg and Pentamerus limestones of the New York geologists) and the Catskill or Delthyris shaly limestone. Coeymans and New Scotland are adjacent towns in Albany county, N. Y., through which runs the Helderberg escarpment affording the finest exposures of these formations.

22. Becraft limestone. This name was introduced by N. H. Darton with the sanction of Professor James Hall, for the beds previously known as the Upper

Pentamerus and Scutella limestones of the Helderberg sections. The present name is derived from Becraft mountain, Columbia county, N. Y.

23. Kingston beds (new). The 'upper shaly beds' of W. M. Davis, which are typically exposed and attain a thickness of 250 feet in the vicinity of Kingston, N. Y.

24. Esopus grit. Proposed by Darton, with the approval of Professor Hall, for the old term Caudagalli grit. It has been suggested by Frech that the Esopus grit should be regarded as a part of the arenaceous sediments of the Oriskany. The very few fossils which it contains, however, do not as yet fully endorse this suggestion.

25. Catskill sandstone. This is an approximate expression of the value of this formation. Catskill sedimentation doubtless began as early as Portage time, its representation during which is expressed in the term, Oneonta beds.

John M. Clarke,
Charles Schuchert.

FISH FAUNA OF THE WOODS HOLE REGION.

In the issue of Science for October 21st, 1898, the writer noticed the capture in the vicinity of Woods Hole, Mass., within a few years, of 12 species of fishes new to the fauna of southern New England, including 5 not previously known from United States waters. These additions raised the number of species recorded from the Woods Hole region to 222, including 11 strictly fresh-water forms.

The summer and fall of 1899 yielded an extraordinary number of unlooked-for species. Although the season was in some respects unfavorable, owing partly to the almost total absence from the inshore waters of the floating sargasso-weed under which the tropical forms drift in from the Gulf Stream, and although a number of the regular visitants were tardy in arriving and appeared in only limited numbers, the season as a whole was unprecedented for the number of new and rare fishes taken. Most of the species to be mentioned were observed only in Katama Bay, a small body of shallow water separating the eastern end of Martha's Vineyard from Chappaquiddick Island. On August 30th, when this bay was first visited by a party from the Fish Commission laboratory, 4 species not previously known from the region were noted, in addition to a number of rare southern forms. Between that date and October 17th, the bay was industriously seined, at short intervals of time, along about one mile of the eastern shore, and the subtropical fishes were invariably found. On September 1st no less than 9 other species new to the locality were detected, and 4 others were obtained on September 16th, 19th, and 29th. By November 18th, when the last visit was made, the water temperature had fallen to 47° and no rare kinds were caught.

At times the number of species represented in a single seine-haul in Katama Bay was unprecedented for the Woods Hole section, and surpassed by but few Florida or West Indian records. Thus, on September 1st, the record for the day was 56 species, of which 47 were taken at one set, including 7 species not reported from points north of Florida until this year.

The species hereafter mentioned bring the list of Woods Hole fishes to 240. This is a larger number than has been recorded from any other locality in the United States with the exception of Key West, in which region upwards of 250 species have been noted.

RARE SPECIES OBSERVED IN 1899.

Exocœtus heterurus Rafinesque. Flying-fish. Very rare; in 1886 and possibly on one previous occasion this fish has been detected at Woods Hole. A specimen 12 inches long was seined at Menemsha Bight, Martha's Vineyard, on August 1st, 1899; at the same place another, somewhat smaller, was caught in a fish trap on August 21st.

Rachycentron canadum (Linnæus). Cobia; Crab-eater. Rarely observed in recent years and none for a number of seasons; commoner 25 years ago than at any time since; only small (5 or 6 pound) specimens